

REMARKS

In view of the foregoing amendments and following remarks responsive to the Office Action of July 8, 2002, Applicant respectfully requests favorable reconsideration of this application.

In Section 1 of the Office Action, the Patent and Trademark Office (Office) rejected Claims 2-7, 12 and 13 under 35 U.S.C. §112, second paragraph, as indefinite. Particularly, the Office asserted that Claim 2 is inaccurate, indefinite and confusing because "second ground plane" is formed between the dielectric substrate and the first ground plane, whereas Claim 1 recites that the patch is disposed on the substrate, which is disposed on the ground plane. The Office asserted that all embodiments show the patch, dielectric and ground plane integrally layered on top of each other in that order and, therefore, the second ground plane can only be the ground plane 10 in Figure 2B and not the ground plane 24 because the antenna is designed around the ground plane directly beneath the patch and its supporting dielectric substrate.

Applicant respectfully traverses this rejection. However, Applicant does not necessarily object to amending the claim in any way that makes it more definite without changing its intended scope. Nevertheless, Applicant simply does not understand this rejection. More particularly, Applicant generally agrees with the assertions contained in Section 1 of the Office Action except the assertion that "The second ground plane can only be the ground plane 10 in Figure 2B and not the

ground plane 24 because the antenna is designed around the ground plane directly beneath the patch and its supporting dielectric substrate".

Claim 1 recites that the dielectric substrate is "disposed on the first ground plane". Applicant assumes that the Office does not dispute that Claim 1 covers the embodiment of the invention shown in Figure 3 of the present application, in which there is only one ground plane 10 and the substrate 11 is directly disposed on it. If so, there does not appear to be any rule of claim construction that prevents this claim from also reading on the Figure 2B embodiment in which there is a second ground plane 24 disposed on and suspended above a first ground plane 10 and wherein the substrate 11 and microstrip 12 are disposed on top of the ground plane 24. Furthermore, Applicant is unaware of any claim construction rule that would prevent an interpretation of Claim 1 in which the first conductive ground plane is either first ground plane 10 or second ground plane 24 when read on the Figure 2B embodiment.

Dependent Claim 2 then adds the limitation of "a second ground plane formed between the dielectric substrate and the first ground plane..." Thus, in the context of reading Claim 2 onto the embodiment of Figure 2B, the first conductive ground plane should be ground plane 10 and the second ground plane should be ground plane 24. However, it appears that the Office is taking the position that, because Claim 1 recites that the dielectric substrate is disposed on the first ground plane, "the first ground plane" can refer to only the ground plane 24 immediately

below the dielectric layer 11. However, this conclusion is inconsistent with well known claim interpretation rules. Clearly, in the Figure 2B embodiment of the invention, the substrate 11 is "disposed on" substrate 24 as well as substrate 10. Specifically, substrate 24 is "disposed on" ground plane 24 and ground plane 24 is "disposed on" ground plane 10. Therefore, substrate 24 is "disposed on" ground plane 10.

It is a well known claim construction rule that limitations can be added in dependent claims that add additional elements interposed between elements recited in the parent claim. A claim such as the present claim in which layers of a structure are recited is a classic example of a situation in which this rule is often applied. For instance, if an independent claim recites a laminate structure comprising layer A on top of layer B on top of layer D, a dependent claim can add optional layer C disposed between layers B and D. This would not violate any rule of claim construction of which applicant is aware. As another example, a dependent method claim can add a step that occurs between two previously recited steps.

It is not seen how the present situation is any different from either of these two classic examples. In fact, the present claims are, for all intents and purposes, identical to the laminate example. Claim 2 quite literally is adding a layer between the first ground plane and the substrate, that layer being the second ground plane. Accordingly, Applicant respectfully requests the Office to withdraw the rejection under 35 U.S.C. §112.

In sections 2 and 3 of the Office Action, the Office rejected Claims 1, 8, 15 and 18 under 25 U.S.C. §102(b) as anticipated by Niehenke (U.S. Patent No. 5,201,065).

The present invention relates to a microstrip antenna with improved low angle performance while not diminishing performance closer to the zenith. Particularly, the improvement in low angle gain of the microstrip antenna is brought about primarily by two features of the design. The first feature is a dielectric lens that encapsulates the patch of the antenna and refracts electromagnetic waves directed to and from the patch so as to increase the gain at low angles. The second feature is the placement of the patch antenna on a second ground plane raised above a first ground plane. The second, raised ground plane further enhances the refraction effect, thereby increasing radiation gained at low angles without diminishing gain at the zenith.

Niehenke discloses in Figure 5 and column 5, lines 35-42 a microstrip antenna comprising an antenna element 114 disposed beneath a focusing lens 142 located in a window 140 of a housing 136. The antenna element 114 comprises a microstrip layer disposed on a substrate 102. The substrate is disposed on a ground plane 130.

Niehenke does not disclose a second ground plane disposed above the first ground plane and, in fact, the Office has conceded as much. Further, while Niehenke discloses a lens 142 in Figure 5, there is essentially no discussion of the

purpose, function, effect or nature of the lens and it is plainly apparent from Figure 5 that the arrangement of cover 138, window 140, and focusing lens 142 that it only allows radiation very close to the zenith to pass through lens 142 and strike the antenna element 114. Specifically, it is separated from the microstrip 114 by an air gap of substantial height and the lens is of the same size as the microstrip 114 and positioned directly above it such that this lens cannot possibly direct low angle radiation to or from the microstrip. Accordingly, while Niehenke discloses a lens disposed above the microstrip, the lens does not meet the express limitation of Claim 1 of "increas[ing] radiation gain at low angles".

As can be seen in, for instance, Figures 2A, 2B, 3 and 4 in the present application, the lens 20 completely surrounds the microstrip and, in particular, extends over and beyond the lateral edges of the microstrip in order to focus low angle energy onto the microstrip. Even in the embodiment of Figure 4, which includes an air gap 34 between the lens 20 and the antenna element, the lens extends over and beyond the lateral edges of the microstrip.

Accordingly, Claim 1 clearly and expressly distinguishes over Niehenke.

Claim 8 depends from Claim 1 and, therefore, clearly distinguishes over the prior art for the reasons given above with respect to Claim 1.

Claim 15 is an independent method claim that includes essentially the same limitations discussed above in connection with Claim 1, namely, that the "dielectric lens... increase[s] radiation gain at low angles". Claim 18 depends from Claim 15.

Accordingly, Claims 15 and 18 distinguish over the prior art of record for the reasons given above in connection with Claim 1.

In sections 4 and 5 of the Office Action, the Office rejected Claims 2-7, 9-14, 16, 17, and 19-23 under 35 U.S.C. §103(a) as being obvious over Niehenke in view of Nichols (U.S. Patent No. 5,691,726). Particularly, the Office asserted that Nichols shows in Figure 5, for example, a second ground plane 122 or 36 between the ground plane 122 and patch 34, and a space between the ground planes for providing additional elements therein. The Office asserted that it also shows an additional antenna element, monopole 126 disposed through the patch 34. The Office asserted that it would have been obvious to employ the antenna arrangement of Nichols in lieu of that in Niehenke for the purpose of providing multi-band operation. The Office further noted that Niehenke shows the lens 142 as a dome and an air gap between the lens and the patch and that Nichols also shows the dielectric cap 120 surrounding the monopole 126. Finally, the Office has asserted that a feed pin 38 is obvious in lieu of a corporate feed network or strip line feeder.

All of these dependent claims distinguish over the combination of Niehenke and Nichols for the same reasons discussed in connection with independent Claims 1 and 15, from which they depend. Particularly, regardless of whatever else it may teach, Nichols does not add the teaching missing from Niehenke with respect to the lens improving low angle gain. Nichols does not even disclose a lens.

In addition, Claim 4 recites that "the dielectric lens covers completely the patch and the dielectric substrate". As discussed above, this feature is key in providing the improved low angle gain. Niehenke, on the other hand, does not meet this limitation as its lens 142 clearly does not completely cover the patch and the dielectric substrate.

Accordingly, Claim 4 even further distinguishes over the prior art of record.

Furthermore, the proposed combination of Niehenke with Nichols is not suggested in the prior art. Particularly, it is well established that two references cannot properly be combined to formulate an obviousness rejection unless there is a teaching in the prior art suggesting that the references be combined in the manner necessary to arrive at the claimed invention. No such suggestion exists in the present case. Particularly, the primary teaching of Nichols that the Office relies upon is the teaching of a second, raised ground plane. However, the purpose of combining the second, raised ground plane with the lens in the present invention is to further improve low angle gain of the antenna. However, neither of the references, Niehenke and Nichols has anything to do with improving low angle gain of the antenna. As discussed above, Niehenke actually excludes any and all low angle radiation. Likewise, Nichols has absolutely nothing to do with low angle radiation and provides a raised ground plane for totally unrelated reasons. Accordingly, these references cannot possibly provide a suggestion that they be combined to improve low angle gain of the antenna.

Applicant recognizes that the required suggestion to make a combination does not need to be for the same reasons that the Applicant provides. However, that does not help the Office's position in this case. First, the Office has offered no reason at all to make the combination of the raised ground plane and low angle lens. Without the impetus of improving low angle gain of the lens, there does not appear to be any reason why one skilled in the art would have any reason to combine these two features.

Accordingly, the rejection of Claims 2-7, 9-14, 16, 17, and 19-23 as obvious over the proposed combination must fail for this additional reason.

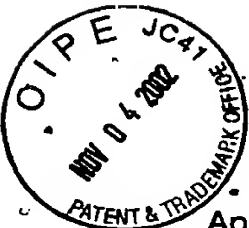
Applicant has herein made minor amendments to the specification and to Claim 1 in order to correct typographical errors. No other changes have been made to the specification or claims.

An early and favorable response is earnestly solicited. Thank you.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

The paragraph beginning on page 8, line 16 has been replaced with the following paragraph:

—Further, lens 20 and dielectric cap 32 may be formed integrally with each other, such as [has] by a single-piece molding.—

In the Claims:

1. (Amended) A microstrip antenna comprising:
 - a first conductive ground plane;
 - a dielectric substrate disposed on the first ground plane;
 - a patch disposed on the dielectric substrate;
 - feed means for electrically feeding the patch; and
 - a dielectric lens for encapsulating at least a portion of the patch to increase radiation gain at low angles.

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